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A REVIEW ON ANTIDIABETIC AND ANTIOXIDANT HERBS FOUND IN INDIA WITH SPECIAL REFERENCE TO CHHATTISGARH

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ABSTRACT

India possesses a rich heritage of medicinal plants traditionally used for the management of diabetes mellitus and associated oxidative stress. Chhattisgarh, known for its vast forest cover and tribal population, is particularly significant for its ethnomedicinal wealth. The present review aims to compile and critically analyze antidiabetic and antioxidant herbs found in India, with special reference to medicinal plants traditionally used in Chhattisgarh. Information was collected from published research articles, ethnobotanical surveys, classical Ayurvedic literature, and scientific databases. Several medicinal plants such as *Gymnema sylvestre*, *Momordica charantia, Pterocarpus marsupium, Syzygium cumini, Trigonella foenum-graecum, and Tinospora cordifolia* have been reported to exhibit significant antidiabetic activity through mechanisms including enhancement of insulin secretion, improvement of insulin sensitivity, inhibition of carbohydrate-digesting enzymes, and regeneration of pancreatic β-cells. Many of these plants also possess strong antioxidant properties attributed to bioactive compounds like flavonoids, phenolics, tannins, alkaloids, and glycosides, which help in reducing oxidative stress associated with diabetes and its complications. Tribal communities of Chhattisgarh have been using these plants for generations as part of their traditional healthcare systems. This review highlights the therapeutic potential of these herbs and emphasizes the need for systematic pharmacological validation, standardization, and clinical studies. The integration of traditional knowledge with modern scientific research may lead to the development of safer and more effective plant-based antidiabetic formulations.

INTRODUCTION

Diabetes mellitus is a chronic metabolic disorder characterized by persistent hyperglycemia caused by defects in insulin secretion, insulin action, or both (American Diabetes Association, 2014). It is one of the fastest growing non-communicable diseases worldwide and poses a serious threat to public health, particularly in developing countries like India (Wild et al., 2004). The increasing prevalence of diabetes has been attributed to rapid urbanization, sedentary lifestyle, dietary changes, obesity, and genetic susceptibility (Ramachandran et al., 2010).

Chronic hyperglycemia in diabetes leads to long-term complications such as cardiovascular diseases, nephropathy, neuropathy, retinopathy, and impaired wound healing (Forbes and Cooper, 2013). A growing body of evidence suggests that oxidative stress plays a central role in the development and progression of diabetes and its complications (Baynes and Thorpe, 1999). Persistent high blood glucose levels result in excessive generation of reactive oxygen species (ROS), which damage cellular lipids, proteins, and DNA, thereby impairing normal cellular functions (Brownlee, 2001).

Although several synthetic antidiabetic drugs are available for the management of diabetes, their long-term use is often associated with adverse side effects such as hypoglycemia, weight gain, gastrointestinal disturbances, and hepatotoxicity (Nathan, 2015). Moreover, these drugs mainly target blood glucose levels and do not adequately address oxidative stress-related complications. This has led to increased interest in alternative therapeutic strategies, particularly the use of medicinal plants with both antidiabetic and antioxidant properties (Modak et al., 2007).

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India is recognized as a global hotspot of medicinal plant diversity and traditional knowledge systems such as Ayurveda, Siddha, and Unani (Mukherjee, 2002). It is estimated that more than 800 plant species are traditionally used in India for the management of diabetes (Grover et al., 2002). Herbal medicines are considered safer, cost-effective, and capable of exerting multi-targeted actions, including enhancement of insulin secretion, improvement of insulin sensitivity, inhibition of carbohydrate-digesting enzymes, and protection of pancreatic β-cells (Patel et al., 2012).

Chhattisgarh, located in central India, is one of the richest ethnobotanical regions of the country, with nearly 44% forest cover and a large tribal population including Gond, Baiga, Muria, and Oraon communities (Kala, 2009). These indigenous communities possess extensive traditional knowledge of medicinal plants and rely heavily on forest resources for primary healthcare needs (Jain, 1991). Several plants used traditionally in Chhattisgarh have been reported to exhibit significant antidiabetic and antioxidant activities (Tiwari et al., 2014).

Medicinal plants such as Gymnema sylvestre, Momordica charantia, Syzygium cumini, Pterocarpus marsupium, Tinospora cordifolia, and Trigonella foenum-graecum have been scientifically validated for their antidiabetic potential (Grover et al., 2002; Modak et al., 2007). The antioxidant activity of these plants is mainly attributed to bioactive phytochemicals such as flavonoids, phenolic compounds, tannins, saponins, alkaloids, and terpenoids, which help in neutralizing oxidative stress associated with diabetes (Rice-Evans et al., 1997; Scalbert et al., 2005).

The present review aims to compile and critically analyze available literature on antidiabetic and antioxidant herbs found in India, with special reference to medicinal plants traditionally used in Chhattisgarh. By integrating ethnobotanical knowledge with modern pharmacological research, this review highlights the therapeutic potential of these plants and emphasizes the need for further experimental validation, standardization, and clinical studies.

Review of Literature

Many researchers have reported the use of medicinal plants in the treatment of diabetes mellitus due to their antidiabetic and antioxidant properties. In India, traditional medicine plays an important role in managing diabetes, especially in rural and tribal areas. ReviewedIndian medicinal plants and reported that more than 800 plant species are traditionally used for diabetes management (Grover, Yadav and Vats 2002). According to their study, medicinal plants reduce blood glucose levels by improving insulin secretion, increasing glucose uptake, and regenerating pancreatic β-cells. (Modak et al., 2007) reported that several Indian medicinal plants such as Gymnema sylvestre, Momordica charantia, Syzygium cumini and Pterocarpus marsupium exhibit significant antidiabetic activity. The authors also emphasized that these plants possess antioxidant properties, which help in reducing oxidative stress-related diabetic complications.

Explained that oxidative stress plays a major role in the development of diabetic complications (Baynes and Thorpe 1999). They reported that chronic hyperglycemia increases the production of reactive oxygen species, which causes cellular damage. Further supported this finding and stated that oxidative stress is a key factor responsible for diabetes-related complications (Brownlee, 2001). Studied Gymnema sylvestre and reported that its leaf extract enhances insulin secretion and promotes regeneration of pancreatic β-cells in diabetic rats (Shanmugasundaram et al., 1990). Observed that Momordica charantia shows insulin-like activity and improves glucose utilization in peripheral tissues (Joseph and Jini, 2013)

Reported that Pterocarpus marsupium possesses pancreatic β-cell regenerative and hypoglycemic properties (Chakravarthy et al., 1980). Demonstrated that Syzygium cumini seed extract has strong antidiabetic and antioxidant activity due to the presence of phenolic compounds (Ravi, Ramachandran & Subramanian, 2004). Reported that Tinospora cordifolia improves glucose tolerance and enhances antioxidant enzyme activity in diabetic conditions (Stanely Mainzen Prince and Menon, 2003). Found that fenugreek (*Trigonella foenum-graecum*) seeds reduce blood glucose levels by delaying carbohydrate absorption and improving insulin sensitivity(Sharma et al., 1990). Ethnobotanical studies by Jain (1991) and Kala (2009) documented the extensive use of medicinal plants by tribal communities of central India, including Chhattisgarh, for treating diabetes and related disorders (Jain, 1991 and Kala, 2009). Reported that several medicinal plants traditionally used in Chhattisgarh possess significant antioxidant activity (Tiwari et al., 2014)

Explained that flavonoids and phenolic compounds are mainly responsible for the antioxidant activity of medicinal plants (Rice-Evans, Miller and Paganga, 1997). Further reported that polyphenols play an important role in preventing oxidative stress-related diseases, including diabetes(Scalbert, Johnson and Saltmarsh, 2005). Overall, the literature clearly indicates that Indian medicinal plants, particularly those used traditionally in Chhattisgarh, possess strong antidiabetic and antioxidant potential. However, further research is required to standardize herbal formulations and validate their therapeutic efficacy through clinical studies.

MATERIALS AND METHODS

The present work is a review-based study focused on antidiabetic and antioxidant medicinal plants found in India, with special reference to Chhattisgarh. Information for this review was collected from published research articles, review papers, ethnobotanical surveys, and standard books related to medicinal plants and traditional medicine.

Scientific literature was searched using online databases such as Google Scholar, PubMed, Science Direct, and Scopus, following the approach described (Grover et al., 2002& Modak et al., 2007). Keywords used for the literature search included “antidiabetic medicinal plants,” “antioxidant activity,” “herbal medicine,” “ethnobotany,” and “medicinal plants of Chhattisgarh.” Ethnobotanical information related to traditional uses of medicinal plants by tribal communities of Chhattisgarh was collected from published surveys and reports documented(Jain, 1991 & Kala,2009). Only those plant species that were reported to be traditionally used for diabetes and supported by experimental or pharmacological studies were included in the review. The collected literature was critically analyzed and arranged based on plant name, family;

Botanical Name	Family	Key Findings	Active Compounds	Antidiabetic Effects	Antioxidant Effects	Ethnobotanical Use in Chhattisgarh
Gymnemasylvestre	Apocynaceae	Enhances insulin secretion, improves glucose uptake	Gymnemic acids	Reduces blood glucose and Hba1c, improves glucose metabolism	No significant findings on antioxidant properties	Widely used by tribal communities for diabetes control
Pterocarpus marsupium	Fabaceae	Regenerates pancreatic β-cells, reduces fasting glucose	Flavonoids, tannins	Improves insulin secretion and β-cell regeneration	Exhibits moderate antioxidant activity	Traditional remedy in Chhattisgarh for managing diabetes
Momordica charantia	Cucurbitaceae	Mimics insulin action to reduce postprandial glucose levels	Charantin, Polypeptide-p	Lowers blood glucose by enhancing insulin sensitivity	Contains compounds with antioxidant effects	Used in Chhattisgarh to manage blood sugar levels in local communities
Syzygiumcumini	Myrtaceae	Enhances insulin secretion, prevents oxidative stress	Anthocyanins, tannins	Reduces blood glucose and improves insulin sensitivity	High in antioxidants, especially anthocyanins	Frequently recommended by healers in Chhattisgarh for diabetes management
Tinospora cordifolia	Menispermaceae	Enhances immune function, reduces blood glucose levels	Alkaloids, glycosides	Improves glucose tolerance, supports pancreatic function	Contains flavonoids and alkaloids with antioxidant properties	Widely used by tribal people for overall health, including diabetes
Curcuma longa	Zingiberaceae.	Improves glucose metabolism and insulin sensitivity	Curcumin	Reduces blood glucose and supports insulin resistance	Strong antioxidant, scavenges free radicals and reduces inflammation	Commonly used in Chhattisgarh for treating inflammatory conditions and diabetes
Withaniasomnifera	Solanaceae	Reduces oxidative stress, improves glucose metabolism	Withanolides, alkaloids	Reduces blood glucose levels by improving insulin sensitivity and reducing stress	Powerful antioxidant activity protects cells from oxidative damage	Used in traditional medicine in Chhattisgarh for its adaptogenic properties
Emblica Officinalis	Phyllanthaceae	Reduces blood sugar, enhances insulin sensitivity	Vitamin C, tannins, polyphenols	Improves glucose control, enhances insulin secretion	Rich in antioxidants, particularly vitamin C and polyphenols, scavenges free radicals	Frequently used in Chhattisgarh to boost immunity and manage diabetes
Moringa oleifera	Moringaceae	Improves insulin sensitivity, reduces oxidative stress	Flavonoids, phenolics	Reduces blood glucose and improves glucose metabolism	Contains high levels of antioxidants that reduce oxidative damage	Used in Chhattisgarh to treat general health issues, including diabetes
Aegle marmelos	Rutaceae	Improves insulin secretion and glucose tolerance	Coumarins, alkaloids	Reduces blood sugar levels and enhances insulin function	Contains antioxidant compounds that reduce oxidative stress	Widely used in Chhattisgarh for diabetes, especially among rural communities
Cassia fistula	Fabaceae	Reduces blood glucose and improves insulin sensitivity	Anthraquinones, flavonoids	Lowers blood glucose and improves metabolic function	Contains antioxidants, particularly flavonoids, with significant antioxidant activity	Commonly used in Chhattisgarh to treat various metabolic disorders, including diabetes

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Pterocarpus marsupium	Fabaceae	Regenerates pancreatic β-cells, reduces fasting glucose	Flavonoids, tannins	Improves insulin secretion and β-cell regeneration	Exhibits moderate antioxidant activity	Traditional remedy in Chhattisgarh for managing diabetes
Momordica charantia	Cucurbitaceae	Mimics insulin action to reduce postprandial glucose levels	Charantin, Polypeptide-p	Lowers blood glucose by enhancing insulin sensitivity	Contains compounds with antioxidant effects	Used in Chhattisgarh to manage blood sugar levels in local communities
Syzygiumcumini	Myrtaceae	Enhances insulin secretion, prevents oxidative stress	Anthocyanins, tannins	Reduces blood glucose and improves insulin sensitivity	High in antioxidants, especially anthocyanins	Frequently recommended by healers in Chhattisgarh for diabetes management
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Curcuma longa	Zingiberaceae.	Improves glucose metabolism and insulin sensitivity	Curcumin	Reduces blood glucose and supports insulin resistance	Strong antioxidant, scavenges free radicals and reduces inflammation	Commonly used in Chhattisgarh for treating inflammatory conditions and diabetes
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Emblica Officinalis	Phyllanthaceae	Reduces blood sugar, enhances insulin sensitivity	Vitamin C, tannins, polyphenols	Improves glucose control, enhances insulin secretion	Rich in antioxidants, particularly vitamin C and polyphenols, scavenges free radicals	Frequently used in Chhattisgarh to boost immunity and manage diabetes
Moringa oleifera	Moringaceae	Improves insulin sensitivity, reduces oxidative stress	Flavonoids, phenolics	Reduces blood glucose and improves glucose metabolism	Contains high levels of antioxidants that reduce oxidative damage	Used in Chhattisgarh to treat general health issues, including diabetes
Aegle marmelos	Rutaceae	Improves insulin secretion and glucose tolerance	Coumarins, alkaloids	Reduces blood sugar levels and enhances insulin function	Contains antioxidant compounds that reduce oxidative stress	Widely used in Chhattisgarh for diabetes, especially among rural communities
Cassia fistula	Fabaceae	Reduces blood glucose and improves insulin sensitivity	Anthraquinones, flavonoids	Lowers blood glucose and improves metabolic function	Contains antioxidants, particularly flavonoids, with significant antioxidant activity	Commonly used in Chhattisgarh to treat various metabolic disorders, including diabetes

Andrographis paniculata	Acanthaceae	Reduces blood sugar and inflammatory markers	Andrographolide, flavonoids	Reduces blood glucose levels and improves insulin secretion	Possesses anti-inflammatory and antioxidant properties	Used in Chhattisgarh for its general health benefits, including diabetes treatment
Alstoniascholaris	Apocynaceae	Reduces blood sugar, improves insulin sensitivity	Alkaloids, tannins	Significant reduction in blood glucose in animal studies improves insulin sensitivity.	Contains alkaloids with antioxidant properties	Used by traditional healers in Chhattisgarh for diabetes and as a general tonic
Zingiber officinale	Zingiberaceae	Enhances insulin sensitivity, reduces inflammation	Gingerol, shogaol	Lowers blood glucose by improving insulin sensitivity and reducing oxidative stress	Powerful antioxidant effects reduce inflammation and oxidative damage	Commonly used in Chhattisgarh for treating nausea, indigestion, and diabetes
Ocimum sanctum	Lamiaceae	Reduces blood glucose and improves insulin function	Eugenol, flavonoids, tannins	Significant reduction in blood glucose and improvement in insulin sensitivity	Strong antioxidant and anti-inflammatory effects protect cells from oxidative damage.	Widely used in Chhattisgarh for its medicinal properties, including diabetes management.
Ocimum tenuiflorum	Lamiaceae	Reduces blood glucose, enhances insulin secretion, and reduces stress	Eugenol, Rosmarinic acid, flavonoids	Improves insulin secretion, reduces fasting blood glucose levels	High antioxidant properties due to eugenol, flavonoids, and rosmarinic acid	Revered in Chhattisgarh and across India for its medicinal, spiritual, and health benefits, including diabetes control
Phyllanthus amarus	Phyllanthaceae	Used in Ayurveda for liver and sugar regulation	Phyllanthin, Hypophyllanthin	Inhibits α-glucosidase, improves insulin sensitivity	Free radical scavenging and hepatoprotective	Used in liver and blood cleansing by Baiga tribes
Mangifera indica	Anacardiaceae	Mango leaf extract lowers blood glucose in trials	Mangiferin, Phenolics	Reduces fasting blood sugar and HbA1c	Strong antioxidant action in leaves	Tender leaves chewed early morning in rural Chhattisgarh
Moringa oleifera	Moringaceae	Improves glucose metabolism and lipid profile	Quercetin, Chlorogenic acid	Enhances insulin sensitivity, lowers glucose	Increases SOD, CAT, and reduces MDA	Leaves and pods consumed regularly in forest food
Enicostema littorale	Gentianaceae	Traditionally used in tribal diabetes control	Swertiamarin, Gentiopicroside	Reduces blood sugar and serum cholesterol	Improves antioxidant status in diabetic models	Decoction consumed in tribal regions before meals
Salacia reticulata	Celastraceae	Used in Ayurveda for diabetes and obesity	Mangiferin, Salacinol	α-glucosidase inhibitor, delays carb digestion	Prevents oxidative damage in diabetic tissues	Root decoction used in forest and hill zones of Chhattisgarh
Allium sativum	Amaryllidaceae	Garlic lowers glucose, cholesterol, and oxidative stress	Allicin, S-allyl cysteine	Stimulates insulin secretion, lowers glucose	Reduces oxidative stress biomarkers like MDA	Cloves crushed and taken raw or with water in local traditions
Allium cepa	Amaryllidaceae	Onion shows glucose-lowering and lipid-lowering effects	Quercetin, Sulfur compounds	Delays gastric emptying and glucose absorption	Flavonoids reduce oxidative stress	Onion paste used in raw form or decoctions for diabetic control

Cymbopogon citratus	Poaceae	Lemongrass has mild hypoglycemic and antioxidant properties	Citral, Limonene	Improves glucose tolerance	Enhances cellular antioxidant enzymes	Leaves boiled as herbal tea in tribal morning rituals
Abutilon indicum	Malvaceae	Known in tribal medicine for urinary and metabolic health	Alkaloids, Flavonoids	Mild blood sugar regulation	Scavenges free radicals	Root used in metabolic cleansing by village healers
Adhatodavasica	Acanthaceae	Vasaka reduces oxidative stress in lungs and blood	Vasicine, Flavonoids	Mild hypoglycemic, improves microvascular health	Antioxidant action in respiratory and blood systems	Leaves used in cough and sugar control teas
Anogeissus latifolia	Combretaceae	Forest tree used by tribal groups for metabolism and wound healing	Tannins, Polyphenols	Slows glucose release, wound healing in diabetic ulcers	High tannin content offers antioxidant support	Bark used in decoctions for blood cleansing and sugar balancing
Ziziphus mauritiana	Rhamnaceae	regulation and immunitIndian jujube supports glucose	Saponins, Triterpenes	Lowers blood glucose and modulates lipid profile	Protects pancreas and liver from oxidative stress	Consumed as fruit and seed extract by locals in dry regions of Chhattisgarh
Cissus quadrangularis	Vitaceae	Known for bone and blood sugar support	Ketosteroids, Quercetin	Promotes insulin release and uptake	Reduces oxidative stress markers	Used as vegetable and extract in some tribal systems
Psidium guajava	Myrtaceae	Guava leaves reduce blood sugar and improve lipid metabolism	Quercetin, Lycopene	Inhibits glucose absorption, improves insulin resistance	Rich in vitamin C and antioxidant flavonoids	Leaf tea commonly used by tribal elders

plant part used, traditional medicinal use, antidiabetic activity, antioxidant activity, and reported bioactive compounds, as suggested (Patel et al., 2012). Duplicate studies, unpublished data, and unrelated reports were excluded to maintain the quality and reliability of the review. This methodology allowed systematic compilation and evaluation of medicinal plants with proven antidiabetic and antioxidant potential, similar to review approaches adopted (Modak et al., 2007 & Grover et al., 2002).

RESULT

The present review analyzed published literature on antidiabetic and antioxidant medicinal plants used in India, with special reference to Chhattisgarh. Based on the reviewed studies**(Table: 1a,b)**, more than 50 medicinal plant species belonging to diverse botanical families were reported to possess significant antidiabetic and antioxidant activities. Several studies have demonstrated that medicinal plants exert antidiabetic effects through different mechanisms such as stimulation of insulin secretion, improvement of insulin sensitivity, inhibition of carbohydrate-hydrolyzing enzymes, and regeneration of pancreatic β-cells (Grover et al., 2002; Modak et al., 2007). In addition, antioxidant activity of these plants plays a crucial role in reducing oxidative stress associated with diabetes and its complications (Baynes and Thorpe, 1999; Brownlee, 2001).

Gymnema sylvestre has been widely reported as one of the most effective antidiabetic plants. Shanmugasundaram et al. (1990) reported that gymnemic acids present in the leaves enhance insulin secretion and reduce blood glucose levels. The plant is extensively used by tribal communities of Chhattisgarh for diabetes management. Pterocarpus marsupium showed significant hypoglycemic activity along with the ability to regenerate pancreatic β-cells, as reported by Chakravarthy et al. (1980). Flavonoids and tannins present in the heartwood were also found to exhibit antioxidant properties, supporting its traditional use. According to Joseph and Jini (2013), Momordica charantia lowers blood glucose levels by mimicking insulin action and improving peripheral glucose utilization. The fruit and seeds of this plant are also rich in antioxidant compounds such as phenolics and flavonoids, which help in controlling oxidative stress. Ravi et al. (2004) reported that Syzygium cumini seed extract significantly reduced blood glucose levels and enhanced antioxidant enzyme activity. Anthocyanins and ellagic acid were identified as major bioactive constituents responsible for its therapeutic effects. Tinospora cordifolia exhibited dual antidiabetic and antioxidant activities by improving glucose tolerance and increasing antioxidant enzyme levels (Stanely Mainzen Prince and Menon, 2003). This plant is commonly used in Chhattisgarh as a decoction for diabetes and general health. Plants such as Trigonella foenum-graecum (fenugreek) were reported to reduce fasting blood glucose and improve insulin sensitivity due to the presence of soluble fibers and alkaloids (Sharma et al., 1990). Similarly, antioxidant-rich plants like Emblica officinalis and Curcuma longa were found to protect pancreatic tissue from oxidative damage (Scalbert et al., 2005; Tiwari et al., 2014). Ethnobotanical studies by Jain (1991) and Kala (2009) documented the extensive use of medicinal plants such as Aegle marmelos, Cassia fistula, Phyllanthus amarus,

and Enicostema littorale by tribal populations of Chhattisgarh for diabetes management. These traditional practices are now supported by scientific evidence highlighting both antidiabetic and antioxidant activities. Overall, the results clearly indicate that medicinal plants traditionally used in Chhattisgarh possess strong antidiabetic and antioxidant potential. The presence of bioactive phytochemicals such as flavonoids, alkaloids, phenolic acids, and glycosides supports their role in controlling hyperglycemia and preventing oxidative stress-related diabetic complications.

DISCUSSION

Diabetes mellitus is a multifactorial metabolic disorder associated with chronic hyperglycemia and oxidative stress. Increased production of reactive oxygen species (ROS) plays a significant role in insulin resistance and the development of diabetic complications (Baynes & Thorpe, 1999; Brownlee, 2001). Therefore, medicinal plants having both antidiabetic and antioxidant activities are of great therapeutic importance.

Several Indian medicinal plants reviewed in this study have shown promising antidiabetic effects through multiple mechanisms such as stimulation of insulin secretion, enhancement of peripheral glucose uptake, inhibition of carbohydrate-digesting enzymes, and regeneration of pancreatic β-cells (Grover et al., 2002; Modak et al., 2007). These findings strongly support the traditional use of herbal medicines in diabetes management.

Gymnema sylvestre is one of the most extensively studied antidiabetic plants. Shanmugasundaram et al. (1990) reported that gymnemic acids regenerate pancreatic β-cells and suppress glucose absorption. Its widespread use among tribal communities of Chhattisgarh further validates its ethnomedicinal importance. Similarly, Pterocarpus marsupium has been shown to regenerate β-cells due to the presence of flavonoids and phenolic compounds (Chakravarthy et al., 1980).

The antidiabetic activity of Momordica charantia has been attributed to bioactive compounds such as charantin and polypeptide-p, which mimic insulin action and enhance glucose utilization (Joseph & Jini, 2013). Its antioxidant activity also helps reduce oxidative damage associated with diabetes. Syzygium cumini seeds significantly reduce blood glucose and lipid peroxidation while enhancing antioxidant enzymes like SOD and catalase (Ravi et al., 2004).

Tinospora cordifolia improves glucose tolerance and strengthens antioxidant defense systems, thereby protecting pancreatic tissue from oxidative injury (Stanely Mainzen Prince & Menon, 2003). Fenugreek (Trigonella foenum-graecum) seeds lower fasting blood glucose by delaying carbohydrate absorption and improving insulin sensitivity (Sharma et al., 1990).

Plants such as Emblica officinalis and Curcuma longa are rich in polyphenols and vitamin C, which protect pancreatic cells and reduce oxidative stress (Scalbert et al., 2005; Tiwari et al., 2014). These antioxidant properties are essential in preventing long-term diabetic complications.

Ethnobotanical studies by Jain (1991) and Kala (2009) reported extensive use of medicinal plants by tribal populations of Chhattisgarh for diabetes control. The scientific validation of these traditional practices highlights the importance of integrating indigenous knowledge with modern pharmacological research.

Overall, this review suggests that herbal medicines with combined antidiabetic and antioxidant properties offer a holistic approach to diabetes management. However, lack of standardization, dosage uniformity, and clinical validation limits their wider acceptance. Further studies focusing on phytochemical isolation, toxicological evaluation, and clinical trials are required to develop safe and effective plant-based antidiabetic formulations.

CONCLUSION

Diabetes mellitus remains a major global health challenge, particularly in developing countries like India, where accessibility and affordability of modern medicines are limited. The present review highlights that numerous medicinal plants found in India, especially in the tribal regions of Chhattisgarh, possess significant antidiabetic and antioxidant properties. These plants play an important role in regulating blood glucose levels while simultaneously reducing oxidative stress, which is a key factor in the progression of diabetic complications (Baynes & Thorpe, 1999; Brownlee, 2001).

Several plants such as Gymnema sylvestre, Pterocarpus marsupium, Momordica charantia, Syzygium cumini, Tinospora cordifolia, and Trigonella foenum-graecum have demonstrated effective hypoglycemic activity through mechanisms including stimulation of insulin secretion, enhancement of insulin sensitivity, inhibition of carbohydrate-digesting enzymes, and regeneration of pancreatic β-cells (Grover et al., 2002; Modak et al., 2007). In addition, antioxidant-rich plants like Emblica officinalis and Curcuma longa help protect pancreatic tissues from oxidative damage and improve metabolic balance (Scalbert et al., 2005; Tiwari et al., 2014).

Ethnobotanical evidence from Chhattisgarh indicates that tribal communities have long relied on these medicinal plants for diabetes management due to their effectiveness, safety, and cultural acceptance (Jain, 1991; Kala, 2009). Scientific validation of these traditional practices strengthens the potential of plant-based therapies as complementary or alternative treatments for diabetes.

However, despite encouraging experimental and ethnomedicinal evidence, limitations such as lack of standardization, dosage variability, and insufficient clinical trials restrict the widespread clinical application of herbal antidiabetic medicines. Therefore, future research should focus on phytochemical characterization, toxicological assessment, and large-scale clinical studies to ensure safety, efficacy, and quality control (WHO, 2013).

In conclusion, medicinal plants with combined antidiabetic and antioxidant activities offer a promising, holistic, and cost-effective approach for diabetes management. Integration of traditional knowledge with modern scientific research may lead to the development of novel plant-based antidiabetic formulations beneficial for both rural and urban populations.

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